THE ASTROPHYSICAL JOURNAL

CONTENTS OF VOLUME 495, PART 1

1998 MARCH 1, Number 1

A VIDEOTAPE ACCOMPANIES THIS ISSUE

| | Page |
|---|---|
| VISUALIZATION OF COLD + HOT AND COLD DARK MATTER COSMOLOGIES VERSUS CfA1 DATA ◉<br>*Dominique Brodbeck, Doug Hellinger, Richard Nolthenius, Joel Primack, & Anatoly Klypin* | 1 |
| ON THE EULERIAN APPROACH TO THE EVOLUTION OF LARGE-SCALE STRUCTURES<br>*A. P. Raposo, J. Buitrago, & L. J. Goicoechea* | 9 |
| SCALING RELATIONS FOR GRAVITATIONAL CLUSTERING IN TWO DIMENSIONS<br>*J. S. Bagla, S. Engineer, & T. Padmanabhan* | 25 |
| DETERMINATION OF THE BARYON DENSITY FROM LARGE-SCALE GALAXY REDSHIFT SURVEYS<br>*David M. Goldberg & Michael A. Strauss* | 29 |
| RECOVERY OF THE POWER SPECTRUM OF MASS FLUCTUATIONS FROM OBSERVATIONS OF THE Ly$\alpha$ FOREST<br>*Rupert A. C. Croft, David H. Weinberg, Neal Katz, & Lars Hernquist* | 44 |
| PHYSICAL PROPERTIES OF THE Ly$\alpha$ FOREST IN A COLD DARK MATTER COSMOLOGY ◉<br>*Yu Zhang, Avery Meiksin, Peter Anninos, & Michael L. Norman* | 63 |
| STATISTICAL PROPERTIES OF X-RAY CLUSTERS: ANALYTIC AND NUMERICAL COMPARISONS ◉<br>*Greg L. Bryan & Michael L. Norman* | 80 |
| THE WARPS SURVEY. II. THE log $N$–log $S$ RELATION AND THE X-RAY EVOLUTION OF LOW-LUMINOSITY CLUSTERS OF GALAXIES<br>*L. R. Jones, C. Scharf, H. Ebeling, E. Perlman, G. Wegner, M. Malkan, & D. Horner* | 100 |
| THE VIRGO CLUSTER DISTANCE FROM 21 CENTIMETER LINE WIDTHS<br>*Martin Federspiel, G. A. Tammann, & Allan Sandage* | 115 |
| DISKS IN EXPANDING FRW UNIVERSES<br>*A. Feinstein, J. Ibáñez, & Ruth Lazkoz* | 131 |
| MORPHOLOGICAL TRANSFORMATION FROM GALAXY HARASSMENT ◉<br>*Ben Moore, George Lake, & Neal Katz* | 139 |
| THE FORMATION OF QUASARS IN LOW-LUMINOSITY HOSTS VIA GALAXY HARASSMENT ◉<br>*George Lake, Neal Katz, & Ben Moore* | 152 |
| GRAVITATIONAL LENSING BY SPIRAL GALAXIES<br>*C. R. Keeton & C. S. Kochanek* | 157 |
| *ASCA* OBSERVATIONS OF THE LENSING CLUSTERS CL 0500−24, CL 2244−02, AND A370: MASS DETERMINATIONS AND COMPARISONS<br>*Naomi Ota, Kazuhisa Mitsuda, & Yasushi Fukazawa* | 170 |
| ORIENTATION OF SPIN VECTORS OF BRIGHT FIELD DISK GALAXIES IN THE LOCAL SUPERCLUSTER AND ITS IMPLICATION<br>*F. X. Hu, Q. R. Yuan, H. J. Su, G. X. Wu, & Y. Z. Liu* | 179 |
| TRANSFORMATION OF GALAXIES. II. GASDYNAMICS IN MERGING DISK GALAXIES: ADDENDUM ◉<br>*Joshua E. Barnes & Lars Hernquist* | 187 |
| AN INVESTIGATION INTO THE GEOMETRY OF SEYFERT GALAXIES<br>*C. J. Clarke, A. L. Kinney, & J. E. Pringle* | 189 |
| A NEAR-INFRARED IMAGING STUDY OF SEYFERT GALAXIES WITH EXTENDED EMISSION-LINE REGIONS<br>*Almudena Alonso-Herrero, Chris Simpson, Martin J. Ward, & Andrew S. Wilson* | 196 |
| BALMER LINE VARIATIONS IN THE RADIO-LOUD ACTIVE GALACTIC NUCLEUS PG 1512+370<br>*P. Romano, P. Marziani, & D. Dultzin-Hacyan* | 222 |

| | Page |
|---|---|
| AN UNUSUAL RADIO GALAXY IN ABELL 428: A LARGE, POWERFUL FR I SOURCE IN A DISK-DOMINATED HOST<br>*Michael J. Ledlow, Frazer N. Owen, & William C. Keel* | 227 |
| RECENT X-RAY OBSERVATIONS AND THE EVOLUTION OF HOT GAS IN ELLIPTICAL GALAXIES: EVIDENCE FOR CIRCUMGALACTIC GAS<br>*Fabrizio Brighenti & William G. Mathews* | 239 |
| SYSTEMATIC BIASES IN GALAXY LUMINOSITY FUNCTIONS<br>*Julianne J. Dalcanton* | 251 |
| HIGH-DENSITY AND HIGH-TEMPERATURE CIRCUMNUCLEAR MOLECULAR DISK IN M51<br>*Satoki Matsushita, Kotaro Kohno, Baltasar Vila-Vilaro, Tomoka Tosaki, & Ryohei Kawabe* | 267 |
| THE [O III] EMISSION-LINE NEBULA OF THE $z = 3.594$ RADIO GALAXY 4C +19.71<br>*L. Armus, B. T. Soifer, T. W. Murphy, Jr., G. Neugebauer, A. S. Evans, & K. Matthews* | 276 |
| ANALYSIS OF THE HOT STELLAR POPULATION OF THE GLOBULAR CLUSTER $\omega$ CENTAURI<br>*Jonathan H. Whitney, Robert T. Rood, Robert W. O'Connell, Noella L. D'Cruz, Ben Dorman, Wayne B. Landsman, Ralph C. Bohlin, Morton S. Roberts, Andrew M. Smith, & Theodore P. Stecher* | 284 |
| A PRESCRIPTION FOR BUILDING THE MILKY WAY'S HALO FROM DISRUPTED SATELLITES<br>*Kathryn V. Johnston* | 297 |
| A PROPOSED MODIFICATION OF THE RATE EQUATIONS FOR REACTIONS ON GRAIN SURFACES<br>*P. Caselli, T. I. Hasegawa, & Eric Herbst* | 309 |
| SPECTRAL OBSERVATIONS OF DIFFUSE FAR-ULTRAVIOLET EMISSION FROM THE HOT PHASE OF THE INTERSTELLAR MEDIUM WITH THE DIFFUSE ULTRAVIOLET EXPERIMENT<br>*Eric J. Korpela, Stuart Bowyer, & Jerry Edelstein* | 317 |
| TEMPERATURE AND DENSITY FLUCTUATIONS IN PLANETARY NEBULAE<br>*John S. Mathis, Silvia Torres-Peimbert, & Manuel Peimbert* | 328 |
| INSTABILITIES IN MOVING PLANETARY NEBULAE<br>*Ruth Dgani & Noam Soker* | 337 |
| A RADIATION HYDRODYNAMIC MODEL FOR PROTOSTELLAR COLLAPSE. I. THE FIRST COLLAPSE<br>*Hirohiko Masunaga, Shoken M. Miyama, & Shu-ichiro Inutsuka* | 346 |
| PARALLEL IMPLEMENTATION OF THE PHOENIX GENERALIZED STELLAR ATMOSPHERE PROGRAM. II. WAVELENGTH PARALLELIZATION<br>*E. Baron & Peter H. Hauschildt* | 370 |
| STOCHASTIC ACCELERATION OF LOW-ENERGY ELECTRONS IN PLASMAS WITH FINITE TEMPERATURE<br>*Julia M. Pryadko & Vahé Petrosian* | 377 |
| ACCRETION AND THE EVOLUTION OF T TAURI DISKS<br>*Lee Hartmann, Nuria Calvet, Erik Gullbring, & Paola D'Alessio* | 385 |
| THE SIMULATION OF NOVA EVOLUTION WITH OPTICALLY THICK WINDS<br>*Attay Kovetz* | 401 |
| A FIT TO THE SIMULTANEOUS BROADBAND SPECTRUM OF CYGNUS X-1 USING THE TRANSITION DISK MODEL<br>*R. Misra, V. R. Chitnis, & Fulvio Melia* | 407 |
| MATTER MIXING FROM AXISYMMETRIC SUPERNOVA EXPLOSION<br>*Shigehiro Nagataki, Tetsuya M. Shimizu, & Katsuhiko Sato* | 413 |
| UNDERSTANDING THE COOL DA WHITE DWARF PULSATOR, G29−38<br>*S. J. Kleinman, R. E. Nather, D. E. Winget, J. C. Clemens, P. A. Bradley, A. Kanaan, J. L. Provencal, C. F. Claver, T. K. Watson, K. Yanagida, A. Nitta, J. S. Dixson, M. A. Wood, A. D. Grauer, B. P. Hine, G. Fontaine, James Liebert, D. J. Sullivan, D. T. Wickramasinghe, N. Achilleos, T. M. K. Marar, S. Seetha, B. N. Ashoka, E. Meištas, E. M. Leibowitz, P. Moskalik, J. Krzesiński, J.-E. Solheim, A. Bruvold, D. O'Donaghue, D. W. Kurtz, B. Warner, Peter Martinez, G. Vauclair, N. Dolez, M. Chevreton, M. A. Barstow, S. O. Kepler, O. Giovannini, T. Augusteijn, C. J. Hansen, & S. D. Kawaler* | 424 |
| DISCOVERY OF THE FAINT X-RAY PULSAR AX J1820.5−1434 WITH *ASCA*<br>*K. Kinugasa, K. Torii, Y. Hashimoto, H. Tsunemi, K. Hayashida, S. Kitamoto, Y. Kamata, T. Dotani, F. Nagase, M. Sugizaki, Y. Ueda, N. Kawai, K. Makishima, & S. Yamauchi* | 435 |
| THE OSCILLATIONS OF TAU PEGASI<br>*E. J. Kennelly, T. M. Brown, R. Kotak, T. A. A. Sigut, S. D. Horner, S. G. Korzennik, P. Nisenson, R. W. Noyes, A. Walker, & S. Yang* | 440 |

# CONTENTS


| | Page |
|---|---|
| ASTEROSEISMOLOGY OF A STAR COOLED BY NEUTRINO EMISSION: THE PULSATING PRE-WHITE DWARF PG 0122+200<br>*M. S. O'Brien, G. Vauclair, S. D. Kawaler, T. K. Watson, D. E. Winget, R. E. Nather, M. Montgomery, A. Nitta, S. J. Kleinman, D. J. Sullivan, X. J. Jiang, T. M. K. Marar, S. Seetha, B. N. Ashoka, J. Bhattacharya, E. M. Leibowitz, S. Hemar, P. Ibbetson, B. Warner, L. van Zyl, P. Moskalik, S. Zola, G. Pajdosz, J. Krzesiński, N. Dolez, M. Chevreton, J.-E. Solheim, T. Thomassen, S. O. Kepler, O. Giovannini, J. L. Provencal, M. A. Wood, & J. C. Clemens* | 458 |
| DYNAMICAL INTERACTION OF SOLAR MAGNETIC ELEMENTS AND GRANULAR CONVECTION: RESULTS OF A NUMERICAL SIMULATION ●<br>*O. Steiner, U. Grossmann-Doerth, M. Knölker, & M. Schüssler* | 468 |
| PROMINENCE FORMATION BY LOCALIZED HEATING<br>*Russell B. Dahlburg, Spiro K. Antiochos, & James A. Klimchuk* | 485 |
| DYNAMIC RESPONSES TO MAGNETIC RECONNECTION IN SOLAR ARCADES ●<br>*Judith T. Karpen, Spiro K. Antiochos, C. Richard DeVore, & Leon Golub* | 491 |
| THE POSTFLARE LOOPS AND THE NEARBY ACTIVE CHROMOSPHERE OF 1992 JUNE 26: ADDENDUM ●<br>*J.-M. Malherbe, T. Tarbell, J. E. Wiik, B. Schmieder, Z. Frank, R. A. Shine, & L. van Driel-Gesztelyi* | 502 |
| RADIATIVE LIFETIMES AND ULTRAVIOLET BRANCHING FRACTIONS FOR RESONANCE LINES OF Co II<br>*K. L. Mullman, J. C. Cooper, & J. E. Lawler* | 503 |
| ERRATA | |
| THE VECTOR MAGNETIC FIELDS AND THERMODYNAMICS OF SUNSPOT LIGHT BRIDGES: THE CASE FOR FIELD-FREE DISRUPTIONS IN SUNSPOTS<br>*K. D. Leka* | 508 |
| AN X-RAY AND OPTICAL STUDY OF MATTER DISTRIBUTION IN CLUSTERS OF GALAXIES<br>*Giuseppe Cirimele, Roberto Nesci, & Dario Trèvese* | 509 |
| INSTRUCTIONS TO AUTHORS | i |


● This paper is supplemented by a videotape segment.

1998 MARCH 10, Number 2


| | |
|---|---|
| CROSS-CORRELATING COSMIC MICROWAVE BACKGROUND RADIATION FLUCTUATIONS WITH REDSHIFT SURVEYS: DETECTING THE SIGNATURE OF GRAVITATIONAL LENSING<br>*Maki Suginohara, Tatsushi Suginohara, & David N. Spergel* | 511 |
| *IRAS* VERSUS POTENT DENSITY FIELDS ON LARGE SCALES: BIASING PARAMETER AND Ω<br>*Yair Sigad, Amiram Eldar, Avishai Dekel, Michael A. Strauss, & Amos Yahil* | 516 |
| STABILITY OF SCALE-INVARIANT COSMOLOGICAL CORRELATION FUNCTIONS IN THE STRONGLY NONLINEAR CLUSTERING REGIME<br>*Taihei Yano & Naoteru Gouda* | 533 |
| A MATTER-ANTIMATTER UNIVERSE?<br>*A. G. Cohen, A. De Rújula, & S. L. Glashow* | 539 |
| CORRELATIONS OF FAINT GALAXIES: A MONTE CARLO APPROACH<br>*Arati Chokshi* | 550 |
| THE SPACE DENSITY OF GALAXY PEAKS AND THE LINEAR MATTER POWER SPECTRUM<br>*Rupert A. C. Croft & Enrique Gaztañaga* | 554 |
| DETERMINATION OF THE PRIMORDIAL MAGNETIC FIELD POWER SPECTRUM BY FARADAY ROTATION CORRELATIONS<br>*Tsafrir Kolatt* | 564 |
| LARGE ANGULAR SCALE POLARIZATION OF THE COSMIC MICROWAVE BACKGROUND RADIATION AND THE FEASIBILITY OF ITS DETECTION<br>*Brian Keating, Peter Timbie, Alexander Polnarev, & Julia Steinberger* | 580 |
| MICROLENSING OF GAMMA-RAY BURST AFTERGLOWS<br>*Abraham Loeb & Rosalba Perna* | 597 |
| GENERAL THEOREM ABOUT GRAVITATIONAL LENSING: EXTENDED RELATION AMONG THE NUMBERS OF IMAGES WITH DIFFERENT PARITIES<br>*Takeshi Fukuyama & Takashi Okamura* | 604 |

# CONTENTS


| | Page |
|---|---|
| A REALISTIC GRID OF MODELS FOR THE GRAVITATIONALLY LENSED EINSTEIN CROSS (Q2237+0305) AND ITS RELATION TO OBSERVATIONAL CONSTRAINTS<br>*Kyu-Hyun Chae, David A. Turnshek, & Valery K. Khersonsky* | 609 |
| TYPE Ia SUPERNOVAE: INFLUENCE OF THE INITIAL COMPOSITION ON THE NUCLEOSYNTHESIS, LIGHT CURVES, AND SPECTRA AND CONSEQUENCES FOR THE DETERMINATION OF $\Omega_M$ AND $\Lambda$<br>*P. Höflich, J. C. Wheeler, & F. K. Thielemann* | 617 |
| ARE LARGE X-RAY CLUSTERS AT THERMAL EQUILIBRIUM?<br>*Jean-Pierre Chièze, Jean-Michel Alimi, & Romain Teyssier* | 630 |
| COMPARING GALAXIES AND Ly$\alpha$ ABSORBERS AT LOW REDSHIFT<br>*Suzanne M. Linder* | 637 |
| DAMPED Ly$\alpha$ ABSORBER AT HIGH REDSHIFT: LARGE DISKS OR GALACTIC BUILDING BLOCKS?<br>*Martin G. Haehnelt, Matthias Steinmetz, & Michael Rauch* | 647 |
| FIRST RESULTS FROM THE LAS CAMPANAS QSO BRIGHTNESS MONITORING PROGRAM<br>*Christopher J. Sirola, David A. Turnshek, Ray J. Weymann, Eric M. Monier, Simon L. Morris, Miguel R. Roth, Wojtek Krzeminski, William E. Kunkel, Oscar Duhalde, & Steven Sheaffer* | 659 |
| THE ULTRAVIOLET-OPTICAL ALBEDO OF BROAD EMISSION LINE CLOUDS<br>*Kirk Korista & Gary Ferland* | 672 |
| ARE SEYFERT NARROW-LINE REGIONS POWERED BY RADIO JETS?<br>*Geoffrey V. Bicknell, Michael A. Dopita, Zlatan I. Tsvetanov, & Ralph S. Sutherland* | 680 |
| THE H$\alpha$ LUMINOSITY FUNCTION AND STAR FORMATION RATE AT $z \sim 0.2$<br>*Laurence Tresse & Steve J. Maddox* | 691 |
| FAR-ULTRAVIOLET SPECTRA OF STARBURST GALAXIES: STELLAR POPULATION AND THE KINEMATICS OF THE INTERSTELLAR MEDIUM<br>*Rosa M. González Delgado, Claus Leitherer, Timothy Heckman, James D. Lowenthal, Henry C. Ferguson, & Carmelle Robert* | 698 |
| BROAD EMISSION LINE VARIABILITY AS A CONSTRAINT UPON THE PHYSICAL CONDITIONS WITHIN THE BROAD EMISSION LINE REGION OF NGC 5548<br>*Mike Goad & Anuradha Koratkar* | 718 |
| WATER MASER EMISSION AND THE PARSEC-SCALE JET IN NGC 3079<br>*Adam S. Trotter, Lincoln J. Greenhill, James M. Moran, Mark J. Reid, Judith A. Irwin, & Kwok-Yung Lo* | 740 |
| *ASCA* OBSERVATIONS OF THE BROAD-LINE RADIO GALAXY 3C 445<br>*Rita M. Sambruna, I. M. George, R. F. Mushotzky, K. Nandra, & T. J. Turner* | 749 |
| SURFACE BRIGHTNESS GRADIENTS PRODUCED BY THE RING WAVES OF STAR FORMATION<br>*V. Korchagin, Y. D. Mayya, E. I. Vorobyov, & A. K. Kembhavi* | 757 |
| THE STELLAR AND GASEOUS KINEMATICS IN NGC 253<br>*F. Prada, C. M. Gutiérrez, & C. D. McKeith* | 765 |
| SPECTRA OF MASER RADIATION FROM A TURBULENT, CIRCUMNUCLEAR ACCRETION DISK<br>*B. K. Wallin, W. D. Watson, & H. W. Wyld* | 774 |
| TWO-COMPONENT FOKKER-PLANCK MODELS FOR THE EVOLUTION OF ISOLATED GLOBULAR CLUSTERS<br>*Sungsoo S. Kim, Hyung Mok Lee, & Jeremy Goodman* | 786 |
| SUPRA–HORIZONTAL-BRANCH STARS AND POPULATION GRADIENTS IN THE GALACTIC CENTER GLOBULAR CLUSTER NGC 6522<br>*M. M. Shara, L. Drissen, R. M. Rich, F. Paresce, I. R. King, & G. Meylan* | 796 |
| THE PHYSICS AND CHEMISTRY OF SMALL TRANSLUCENT MOLECULAR CLOUDS. X. SiO<br>*B. E. Turner* | 804 |
| SELF-GRAVITATIONAL HYDRODYNAMICS WITH THREE-DIMENSIONAL ADAPTIVE MESH REFINEMENT: METHODOLOGY AND APPLICATIONS TO MOLECULAR CLOUD COLLAPSE AND FRAGMENTATION<br>*J. Kelly Truelove, Richard I. Klein, Christopher F. McKee, John H. Holliman II, Louis H. Howell, Jeffrey A. Greenough, & D. Tod Woods* | 821 |
| NONEQUILIBRIUM PHOTODISSOCIATION REGIONS WITH ADVANCING IONIZATION FRONTS<br>*H. Störzer & D. Hollenbach* | 853 |

# CONTENTS


| | Page |
|---|---|
| $C^{18}O$ AND $C^{17}O$ OBSERVATIONS OF EMBEDDED YOUNG STARS IN THE TAURUS MOLECULAR CLOUD. I. INTEGRATED INTENSITIES AND COLUMN DENSITIES<br>*E. F. Ladd, G. A. Fuller, & J. R. Deane* | 871 |
| TEMPERATURE VARIATIONS AND N/O IN THE ORION NEBULA FROM *HST* OBSERVATIONS<br>*R. H. Rubin, P. G. Martin, R. J. Dufour, G. J. Ferland, J. A. Baldwin, J. J. Hester, & D. K. Walter* | 891 |
| IMPLICATIONS OF A SUBTHRESHOLD RESONANCE FOR STELLAR BERYLLIUM DEPLETION<br>*Edward J. Brown* | 905 |
| AN INVESTIGATION OF NEUTRINO-DRIVEN CONVECTION AND THE CORE COLLAPSE SUPERNOVA MECHANISM USING MULTIGROUP NEUTRINO TRANSPORT<br>*A. Mezzacappa, A. C. Calder, S. W. Bruenn, J. M. Blondin, M. W. Guidry, M. R. Strayer, & A. S. Umar* | 911 |
| LARGE VARIATIONS IN THE WINDS OF SINGLE COOL GIANTS: $\lambda$ VELORUM AND $\gamma$ CRUCIS<br>*D. J. Mullan, K. G. Carpenter, & R. D. Robinson* | 927 |
| V446 HERCULIS (NOVA HER 1960) IS AN OPTICAL TRIPLE: IMPLICATIONS FOR THE RESUMPTION OF DWARF NOVA OUTBURSTS FOLLOWING THE NOVA<br>*R. K. Honeycutt, J. W. Robertson, G. W. Turner, & A. A. Henden* | 933 |
| ULTRAFINE STRUCTURE IN THE $\lambda$5797 DIFFUSE INTERSTELLAR ABSORPTION BAND<br>*T. H. Kerr, R. E. Hibbins, S. J. Fossey, J. R. Miles, & P. J. Sarre* | 941 |
| $NH_2$ AND ITS PARENT MOLECULE IN THE INNER COMA OF COMET HYAKUTAKE (C/1996 B2)<br>*Hideyo Kawakita & Jun-ichi Watanabe* | 946 |
| SOLAR ENERGETIC IONS CREATED IN A RECONNECTION LAYER BY ALFVÉN WAVE PICKUP<br>*C. S. Wu, Y. Li, J. K. Chao, Peter H. Yoon, & L. C. Lee* | 951 |
| CONTRAST OF FACULAE AT 1.6 MICRONS<br>*Haimin Wang, Thomas Spirock, Philip R. Goode, Chikyin Lee, Harold Zirin, & Walter Kosonocky* | 957 |
| PREPARATION OF A DUAL WAVELENGTH SEQUENCE OF HIGH-RESOLUTION SOLAR PHOTOSPHERIC IMAGES USING PHASE DIVERSITY<br>*Mats G. Löfdahl, Thomas E. Berger, Richard S. Shine, & Alan M. Title* | 965 |
| MEASUREMENTS OF SOLAR MAGNETIC ELEMENT MOTION FROM HIGH-RESOLUTION FILTERGRAMS<br>*Thomas E. Berger, Mats G. Löfdahl, Richard S. Shine, & Alan M. Title* | 973 |
| ERRATUM | |
| THIRD-ORDER PERTURBATIVE APPROACH TO GRAVITATIONAL INSTABILITY: EVOLUTION OF ISOLATED STRUCTURES AND ENVIRONMENTAL EFFECTS<br>*L. J. Goicoechea & J. Buitrago* | 984 |